Analysis of portwine stain disfigurement and pulsed dye laser treatment results
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General discussion

Some of our results, particularly those that are difficult to explain, warrant further discussion. These include the unpredictability and variability of treatment outcome. Apparently portwine stain skin color has no predictive value concerning number of treatments necessary to achieve optimal clearance.

First, we hypothesize that the color of a portwine stain is inadequate to characterize fully the anatomy, pathophysiology and evolution of the lesion, and neither its response to laser treatment.

Clinically, portwine stains occur solitary and in combination with a number of other vascular malformations. They can be flat or nodular, overlying hypertrophic tissue (25 percent of our patients), or be part of a syndrome, like Sturge-Weber with glaucoma of the involved eye and neurological symptoms. Portwine stains in the face are distributed preferentially along branches of the trigeminal nerve, where the origin of this connection probably lies in the embryonic phase, which is incompletely understood. Consequently, the term portwine stain seems to comprise a large number of vascular malformations with different anatomical and pathophysiological properties. To our best knowledge it is unknown to what extent venules, arterioles or capillaries contribute to the phenomenon portwine stain.

The currently accepted laser therapy is based on the concept of selective photothermolysis. In the case of portwine stain treatment this implies matching the wavelength to the absorption peak of oxyhemoglobin, and choosing the pulse duration so that heat diffusion matches the diameter of one single ectatic blood vessel representing the portwine stain. Obviously, this one vessel concept does not apply to each and every portwine stain, although amazingly, the majority of portwine stains show at least some response.

An interesting thought, evolving from our results, is to try to match treatment parameters with key components of portwine stain disfigurement, such as size, color and sharpness of boundary. This novel approach could reduce the perceived disfigurement faster than the current approach solely aimed at color reduction. The question is whether laser parameters and
treatment strategy can be designed to influence e.g. size and boundary (respectively accounting for 46 percent and 12 percent of the overall disfigurement). Hypothesizing that portwine stain anatomy differs at the periphery of the lesion compared to the center raises the question whether different laser parameters and treatment procedures can be identified that particularly improve clearance at the boundary of the stain. For example, using the double pulse technique described in chapter 4, placing the first pulse on the healthy skin immediately adjacent to the portwine stain, and the second pulse just inside the portwine stain, could possibly produce deeper and hence more effective vessel damage than just pulses aimed at the portwine stain itself. Most likely, diagnostic procedures to assess portwine stain anatomy will contribute to a more rational choice of laser parameters, if technically feasible.

It would be worthwhile to investigate whether different color components contribute differently to overall portwine stain disfigurement. If one of these parameters, L* a* or b*, would be more important than the others for reducing disfigurement, the challenge would be to investigate whether selective decrease of this particular parameter is possible by adjusting laser parameter settings.

The results of the investigations presented in this thesis have raised a number of additional questions, some of which are addressed in this discussion. Undoubtedly, investigating alternative laser parameters and treatment strategies will lead to further improve outcome of laser treatment of portwine stains.